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# Impact of Waist Hip Ratio on Autonomic Modulation in Geriatric Population

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## ABSTRACT

Waist circumference is a predictor of total body fat and related health risks at a population level and a relatively large hip circumference is associated with lower risk of diabetes and coronary heart disease. Waist hip ratio is a better predictor of mortality in older people than waist circumference or BMI. If obesity is redefined using WHR instead of BMI, the proportion of people categorized as a risk of heart attack worldwide increases threefold.This study was aimed to record and asses the Heart rate variability (HRV) with respect to WHR in elderly population involved**.** To assess the autonomic changes, in this study different parameters of HRV were recorded in the elderly people with WHR less than or equal to 0.9 and compared with individuals whose WHR is more than 0.9 during normal (N), deep breathing (DB) and cold pressor test (CPT) conditions, Showed that the SDANN, Time domain HRV was decreased in subjects with higher WHR during cold pressor test compared to normal WHR subjects. Sympathovagal balance is decreased in higher WHR subjects compared to normal WHR subjects in geriatric population; the degree of decrease is more in sympathetic part than parasympathetic.

**Keywords:** HRV, WHR, LF, HF, LF/HF ratio, SDANN

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## INTRODUCTION

Waist circumference was developed initially as a simple measure and a potentially better indicator of health risk than BMI to use in health promotion. People with a large waist are many times more at the risk of ill health including features of metabolic syndromes like diabetes, hypertension and dyslipidaemia.

Waist circumference is a predictor of total body fat and related health risks at a population level. Waist circumference in European women with more than 80cms and in men with more than 94cms, Asians, Chinese, Japanese with waist circumference in women more than 80cms and in men more than 90cms are defined obese by international diabetes federation[1].

Hip circumference does have a relation to health and disease, but in an inverse way, such that a relatively large hip circumference is associated with lower risk of diabetes and coronary heart disease. This is probably because hip circumference reflects muscle mass, which is reduced in type 2 diabetes and in activity.

Waist circumference should be measured mid way between the lower rib margin and iliac crest, with a horizontal tape at the end of gentle expiration. Waist circumference measured at the umbilical level is not reliable because sagging of abdomen skin occurs in very obese subjects and those who have lost weight previously.

Waist hip ratio is the ratio of the circumference of the waist to that of the hips. It measures the proportion by which fat is distributed around the body. A waist hip ratio of 0.7 for women and 0.9 for men has been shown to correlate strongly with general health and fertility. Women within 0.7 ranges have optimal levels of estrogen and are less susceptible to disease such as diabetes and cardiovascular disease and ovarian cancer [2]. Men with waist hip ratio around 0.9, similarly, have been shown to be more healthy and fertile with less prostate cancer and testicular cancer [3].

Waist hip ratio is a better predictor of mortality in older people than waist circumference or BMI [4,5]. If obesity is redefined using WHR instead of BMI, the proportion of people categorized as a risk of heart attack worldwide increases threefold [6].

In this study we are studying the impact of WHR on cardiac autonomic modulation in geriatric population.

## MATEREALS AND METHODS

This study was conducted in the department of Physiology, Kasturba Medical College, Manipal University, Mangalore on the inmates of LITTLE SISTER OLD AGE HOME at Nanthoor circle, Mangalore, Karnataka. We recruited about 80 old aged individuals of the age group of 50 to 85 years, belongs to both the sexes, after their informed and written consent. The study was

approved by institutional ethical committee. A detailed clinical history of all the subjects was taken. Relevant past history, family history, any drug history, personal history like smoking, alcoholism, occupation etc, were also taken. General physical examination, vital signs, complete systemic examination was done. Only medically fit persons were included in the study. Subjects suffering from any systemic disorders and those who are not consented are excluded from the study. Heart rate Variability was recorded using Digital data Acquisition system, HRV soft 1.1 VERSION, AIIMS, NEW DELHI. A high quality ECG recording was taken under standardized condition to minimize artifacts. The ECG signal was first analogally recorded & then digitally converted and analyzed in the time domain and frequency domain. The recording was done in the morning between 8.30 to 9.30am in a cool room temperature of 20 to 28 degree Celsius after breakfast. They were requested to come in a relaxed condition & quiet mood. The room was darkened & without acoustic disturbance. They were instructed to be relaxed and to breathe quietly at their own rate. After a resting period, the subjects ECG were recorded in the supine position during normal breathing for 5 min. After this a break of 2min was given. Then the next ECG recording was taken during deep breathing for 1 min, the procedure was as follows. The subject was asked to inspire for the first 5 seconds from the count of 1 to 5 and expire the next 5 seconds from the count of 5 to 1. This recording was taken for 6 such cycles i.e. for one minute.

**Cold pressor test:** The subjects were asked to keep one hand till wrist in an ice cold box for 1 min, during which the ECG was recorded.

**Waist – Hip Ratio**

Waist was measured using a non – stretchable measuring tape. The subjects were asked to stand erect in a relaxed position with both feet together on a flat surface; one layer of clothing was accepted. Waist girth was measured as the smallest horizontal girth between the costal margins and the iliac crests at minimal respiration.

Hip circumference was measured at the level of trochanters [7].

**Statistical analysis** The statistical analysis was done by using ANOVA, student's unpaired 't' test, Mann Whitney U test, and Tukey's Test. P value was taken as significant at 5 percent confidence level i.e. $p < 0.05$.

## RESULTS

The Study group consists of 80 volunteers (men) in the age group of 50 to 85 years. They were divided in to two groups, each with 40 male subjects whose WHR was less than 0.9 (GroupI) and 40 male subjects whose WHR was more than 0.9 (Group II). The different parameters of HRV under different conditions in these two groups were recorded, tabulated and analyzed (table:-1). In time domain method, the SDANN i.e., standard deviation of adjacent normal to normal beat was taken in different conditions between these two groups were compared. The mean value of SDANN in group I was 20.78±5.80 and group II was 12.71±6.10 in

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Normal breathing condition which showed significantly higher value in Group I. In DB and CPT condition, the mean SDANN value of HRV in the group I was 22.27±10.03 and 18.03±6.40 and in the group II was 10.69±0.89 and 11.91±6.72 respectively .In both these conditions also the SDANN was significantly higher in group I when compared to group II. HRV in frequency domain analysis showed that in normal condition, the LF component of group I was 29.29±10.11 and group II was 25.15±9.76. Here also the group I show's greater value in the LF than group II. The same result was obtained with the LF in the DB and CPT conditions where the LF of group I was 76.48±16.18 and 49.09±17.43 and group II was 70.61±12.63 and 47.25±15.44 respectively. The HF component of HRV during Normal, DB and CPT showed higher values in Group II compared to Group I, values of Group I in N , DB, CPT conditions are 32.84±13.54, 39.48±10.73, 26.80±9.88 and that of Group II are 42.45±18.87, 45.85±20.24, 27.84±11.65 respectively. The LF/HF ratio of Group I was significantly higher when compared to Group II during normal condition with Values 1.099±0.66 and 0.679±0.299 respectively. During DB and CPT condition also Group I showed higher values compared to Group II which is not significant, values are 3.31±1.59, 1.32±0.541 in Group I and 3.03±1.44, 1.19±0.55 in Group II.

**Table 1: Effect of WHR on HRV in Time domain and Frequency domain methods during Normal breathing, Deep breathing and Cold pressor test. n=40 in each group.**

| | HRV | WHR | |
|---|---|---|---|
| | | Group I(≤ 0.9) | Group II(> 0.9) |
| | | Mean ± SD | Mean ± SD |
| NORMAL | SDANN | 20.78±5.80 | 12.71±6.10* |
| | LF | 29.29±10.11 | 25.15±9.76 |
| | HF | 32.84±13.54 | 42.45±18.87 |
| | LF/HF Ratio | 1.099±0.66 | 0.679±0.299 * |
| DEEP BREATHING | SDANN | 22.27±10.03 | 10.69±0.89* |
| | LF | 76.48±16.18 | 70.61±12.63 |
| | HF | 26.80±9.88 | 27.84±11.65 |
| | LF/HF Ratio | 3.31±1.59 | 3.03±1.44 |
| COLD PRESSOR | SDANN | 18.03±6.40 | 11.91±6.72 * |
| | LF | 49.09±17.43 | 47.25±15.44 |
| | HF | 39.48±10.73 | 45.85±20.24 |
| | LF/HF Ratio | 1.32±0.541 | 1.19±0.55 |

Note: Values are mean±SD ; *P <0.05; comparison between Group I and Group II

## DISCUSSION

When HRV was compared with waist hip ratio in elderly, HRV in subjects with higher WHR was lesser than those with lower WHR. This is in agreement with
Previous studies also showed that HRV decreases with increasing WHR. Study in Seoul, South korea showed higher levels of fat mass, percentage fat content, and waist/hip ratio were significantly associated with lower HRV [8].

The study, published Dec. 11 in the journal Circulation, included 24,508 men and women, ages 45 to 79, who were followed for an average of 9.1 years. During that time, 1,708

men and 892 women developed coronary heart disease. Those with the highest waist-to-hip ratio had the highest risk. "The size of the hips seems to predict a protective effect. In other words, a big waist with comparably big hips does not appear to be as worrisome as a big waist with small hips," lead author Dr. Dexter Canoy, a research fellow in epidemiology and public health at the University of Manchester, said in a prepared statement[9].

The waist hip ratio gives a ratio of visceral fat to fat in the remainder of the body, and it reflects visceral fat accumulation (intra abdominal adipose tissue)[10]. Adipocytes in the intra abdominal visceral fat are closely related to metabolism in the liver[11], causing over production of very-low-density lipoprotein and might result in hypertriglyceridemia, hypercholesterolemia and insulin resistance[12]. All these metabolic disorders were proofed to be linked to autonomic disturbance [13].

## CONCLUSION

From this study, we concluded that the HRV decreases with increase in WHR in geriatric population. The degree of decrease in sympathetic activity is earlier than the parasympathetic activity in geriatric population with higher WHR.

## REFERENCES


[1] Debbie A Lawer, Mike lean. BMJ 2006; 333 (18): 1060-1063.
[2] The rules of attraction in game. www.livescience.com/health/060213_attraction.
[3] Men's preference for women's profile waist to hip ratio in two societies Retrieved on 2007-09-01 wikepedia.
[4] American J Clinical Nutrition Aug 12 2006.
[5] Lindsay Wright London School of hygiene and tropical medicine public release date 8 aug 2006.
[6] Obesity and the risk of MI in 27000 participants from 52 countries :a case control study The Lancet, Nov 5-2005.
[7] Diabetes mellitus . A fundamental & clinical text, 2nd edition Chapter 56, obesity in type 2 diabetes mellitus. Page no 567.
[8] A Kim, Yong-Gyu Park, Kyung-Hwan Cho, Myung-Ho Hong, Hee-Chul Han, Youn-Seon Choi and Dokyung Yoon. J Am Board Fam Pract 2005; 18: 97–103.
[9] CIRCULATION 12/11/2007.Abdominal fat tied to high risk for coronary troble.
[10] Cnop M,Havel PJ, Utzschneider KM, Carr DB, Sinha MK, Boyko EJ, Retzlaff BM, KnoppRH, Brunzell JD, Kahn SE. Diabetes care 2003; 6(10): 2964-75.
[11] Fujioka S, Matsuzawa Y, Tokunaga K, SeiichiroT. Metabolism 1987; 36: 54-9.
[12] Richard W Nesto. Test J 2005; 32(3):387-98.
[13] Lindmark S, Lonn L, Wiklund U, Tufvesson M, Olsson T, Eriksson J. Obesity Research 2005; 13: 717-28.